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Complete Summary

GUIDELINE TITLE

ACR Appropriateness Criteria™ for multiple sclerosis -- when and how to image.

BIBLIOGRAPHIC SOURCE(S)

Masdeu JC, Drayer BP, Anderson RE, Braffman B, Davis PC, Deck MD, Hasso AN, Johnson BA, Masaryk T, Pomeranz SJ, Seidenwurm D, Tanenbaum L. Multiple sclerosis--when and how to image. American College of Radiology. ACR Appropriateness Criteria. Radiology 2000 Jun;215(Suppl):547-62. [88 references]

COMPLETE SUMMARY CONTENT

SCOPE

DISEASE/CONDITION(S)

Multiple sclerosis

GUIDELINE CATEGORY

Diagnosis

CLINICAL SPECIALTY

Family Practice
Internal Medicine
Neurology
Radiology

INTENDED USERS

Health Plans
Hospitals

Managed Care Organizations
Physicians
Utilization Management

GUIDELINE OBJECTIVE(S)

To evaluate the appropriateness of initial radiologic examinations for multiple sclerosis

TARGET POPULATION

Patients with multiple sclerosis

INTERVENTIONS AND PRACTICES CONSIDERED

1. Magnetic resonance imaging:
   - Plain
   - + contrast
   - + contrast, delayed imaging
2. Magnetic resonance spectroscopy
3. Computed tomography:
   - Plain
   - + contrast
4. Computed tomography myelography
5. Conventional myelography
6. Single-photon emission computed tomography
7. Positron emission tomography

MAJOR OUTCOMES CONSIDERED

Utility of radiologic examinations in differential diagnosis

METHODOLOGY

METHODS USED TO COLLECT/SELECT EVIDENCE

Searches of Electronic Databases

DESCRIPTION OF METHODS USED TO COLLECT/SELECT THE EVIDENCE

The guideline developer performed literature searches of recent peer-reviewed medical journals, primarily using the National Library of Medicine's MEDLINE database. The developer identified and collected the major applicable articles.

NUMBER OF SOURCE DOCUMENTS

The total number of source documents identified as the result of the literature search is not known.

METHODS USED TO ASSESS THE QUALITY AND STRENGTH OF THE EVIDENCE

Expert Consensus (Delphi Method)
Weighting According to a Rating Scheme (Scheme Not Given)

RATING SCHEME FOR THE STRENGTH OF THE EVIDENCE

Not applicable

METHODS USED TO ANALYZE THE EVIDENCE

Systematic Review with Evidence Tables

DESCRIPTION OF THE METHODS USED TO ANALYZE THE EVIDENCE

One or two topic leaders within a panel assume the responsibility of developing an evidence table for each clinical condition, based on analysis of the current literature. These tables serve as a basis for developing a narrative specific to each clinical condition.

METHODS USED TO FORMULATE THE RECOMMENDATIONS

Expert Consensus (Delphi)

DESCRIPTION OF METHODS USED TO FORMULATE THE RECOMMENDATIONS

Since data available from existing scientific studies are usually insufficient for meta-analysis, broad-based consensus techniques are needed to reach agreement in the formulation of the Appropriateness Criteria. Serial surveys are conducted by distributing questionnaires to consolidate expert opinions within each panel. These questionnaires are distributed to the participants along with the evidence table and narrative as developed by the topic leader(s). Questionnaires are completed by the participants in their own professional setting without influence of the other members. Voting is conducted using a scoring system from 1-9, indicating the least to the most appropriate imaging examination or therapeutic procedure. The survey results are collected, tabulated in anonymous fashion, and redistributed after each round. A maximum of three rounds is conducted and opinions are unified to the highest degree possible. Eighty (80) percent agreement is considered a consensus. If consensus cannot be reached by this method, the panel is convened and group consensus techniques are utilized. The strengths and weaknesses of each test or procedure are discussed and consensus reached whenever possible.

RATING SCHEME FOR THE STRENGTH OF THE RECOMMENDATIONS

Not applicable

COST ANALYSIS

A formal cost analysis was not performed and published cost analyses were not reviewed.

METHOD OF GUIDELINE VALIDATION

Internal Peer Review

DESCRIPTION OF METHOD OF GUIDELINE VALIDATION

Criteria developed by the Expert Panels are reviewed by the American College of Radiology (ACR) Committee on Appropriateness Criteria and the Chair of the ACR Board of Chancellors.

RECOMMENDATIONS

MAJOR RECOMMENDATIONS

ACR Appropriateness Criteria™

Clinical Condition: Multiple Sclerosis

Variant 1: Isolated sensory findings suggestive of multiple sclerosis, no clear-cut localization. First imaging study.

Radiologic Exam Procedure	Appropriateness Rating	Comments
Brain		
Magnetic resonance imaging	8	
Magnetic resonance imaging + contrast	4	
Magnetic resonance imaging + contrast, delayed imaging	2	
Magnetic resonance spectroscopy	2	
Computed tomography	2	
Computed tomography + contrast	2	
Spinal cord		
Magnetic resonance imaging + contrast	4	
Magnetic resonance imaging	3	

Magnetic resonance imaging + contrast, delayed imaging	2	
Magnetic resonance spectroscopy	2	
Computed tomography	2	
Computed tomography + contrast	2	
Appropriateness Criteria Scale 1 2 3 4 5 6 7 8 9 1=Least appropriate 9=Most appropriate		

Clinical Condition: Multiple Sclerosis

Variant 2: Isolated sensory findings suggestive of multiple sclerosis, level suggestive of spinal cord involvement. First imaging study.

Radiologic Exam Procedure	Appropriateness Rating	Comments
Brain		
Magnetic resonance imaging	8	
Magnetic resonance imaging + contrast	4	
Magnetic resonance imaging + contrast, delayed imaging	2	
Magnetic resonance spectroscopy	2	
Computed tomography	2	
Computed tomography + contrast	2	
Spinal cord		
Magnetic resonance imaging	8	
Magnetic resonance imaging + contrast	4	If noncontrast magnetic resonance imaging is positive, contrast enhancement may be useful to further characterize abnormalities.
Magnetic resonance imaging	2	

+ contrast, delayed imaging		
Magnetic resonance spectroscopy	2	
Computed tomography	2	
Computed tomography + contrast	2	
Appropriateness Criteria Scale 1 2 3 4 5 6 7 8 9 1=Least appropriate 9=Most appropriate		

Clinical Condition: Multiple Sclerosis

Variant 3: Motor-sensory findings suggestive of multiple sclerosis, no level suggestive of spinal cord involvement. First imaging study.

Radiologic Exam Procedure	Appropriateness Rating	Comments
Brain		
Magnetic resonance imaging	8	
Magnetic resonance imaging + contrast, delayed imaging	2	
Magnetic resonance imaging + contrast	No Consensus	
Magnetic resonance spectroscopy	2	
Computed tomography	2	
Computed tomography + contrast	2	
Single-photon emission computed tomography	2	
Positron emission tomography	2	
Spinal cord		
Magnetic resonance imaging	4	
Magnetic resonance imaging	4	

+ contrast		
Computed tomography	2	
Computed tomography + contrast	2	
Appropriateness Criteria Scale 1 2 3 4 5 6 7 8 9 1=Least appropriate 9=Most appropriate		

Clinical Condition: Multiple Sclerosis

Variant 4: Motor-sensory findings suggestive of multiple sclerosis, level suggestive of spinal cord involvement. First imaging study.

Radiologic Exam Procedure	Appropriateness Rating	Comments
Brain		
Magnetic resonance imaging	8	
Magnetic resonance imaging + contrast, delayed imaging	2	
Magnetic resonance imaging + contrast	No Consensus	
Magnetic resonance spectroscopy	2	
Computed tomography	2	
Computed tomography + contrast	2	
Single-photon emission computed tomography	2	
Positron emission tomography)	2	
Spinal cord		
Magnetic resonance imaging	8	
Magnetic resonance imaging + contrast	4	If noncontrast magnetic resonance imaging is positive, contrast enhancement may be useful to further characterize abnormalities.

Magnetic resonance spectroscopy	2	
Computed tomography	2	
Computed tomography + contrast	2	
Appropriateness Criteria Scale 1 2 3 4 5 6 7 8 9 1=Least appropriate 9=Most appropriate		

Clinical Condition: Multiple Sclerosis

Variant 5: Subsequent neurological event, initial imaging work-up suggestive of multiple sclerosis.

Radiologic Exam Procedure	Appropriateness Rating	Comments
Brain		
Magnetic resonance imaging	8	
Magnetic resonance imaging + contrast	4	May be indicated for following disease activity or therapeutic protocol.
Magnetic resonance imaging + contrast, delayed imaging	3	
Magnetic resonance spectroscopy	2	
Computed tomography	2	
Computed tomography + contrast	2	
Single-photon emission computed tomography	2	
Positron emission tomography	2	
Spinal cord		
Magnetic resonance imaging	4	Indicated if spinal cord findings are suggestive.
Magnetic resonance imaging	4	

+ contrast		
Magnetic resonance imaging + contrast, delayed imaging	3	
Computed tomography	2	
Computed tomography + contrast	2	
Appropriateness Criteria Scale 1 2 3 4 5 6 7 8 9 1=Least appropriate 9=Most appropriate		

Clinical Condition: Multiple Sclerosis

Variant 6: Subsequent neurological event, initial imaging work-up negative.

Radiologic Exam Procedure	Appropriateness Rating	Comments
Brain		
Magnetic resonance imaging	8	
Magnetic resonance imaging + contrast	No Consensus	
Magnetic resonance spectroscopy	2	
Computed tomography	2	
Computed tomography + contrast	2	
Single-photon emission computed tomography	2	
Positron emission tomography	2	
Spinal cord		
Magnetic resonance imaging	4	Indicated if spinal cord findings are suggestive.
Magnetic resonance imaging + contrast	No Consensus	

Computed tomography	2	
Computed tomography + contrast	2	
<u>Appropriateness Criteria Scale</u> 1 2 3 4 5 6 7 8 9 1=Least appropriate 9=Most appropriate		

<u>Clinical Condition</u>: Multiple Sclerosis

<u>Variant 7</u>: Isolated optic neuritis.

Radiologic Exam Procedure	Appropriateness Rating	Comments
Brain		
Magnetic resonance imaging	8	
Magnetic resonance imaging + contrast	6	
Computed tomography	3	
Computed tomography + contrast	3	
Magnetic resonance spectroscopy	2	
Optic Nerve		
Magnetic resonance imaging	8	
Magnetic resonance imaging + contrast	8	
Computed tomography	4	
Computed tomography + contrast	4	
<u>Appropriateness Criteria Scale</u> 1 2 3 4 5 6 7 8 9 1=Least appropriate 9=Most appropriate		

<u>Clinical Condition</u>: Multiple Sclerosis

Variant 8: Any presentation suggestive of multiple sclerosis. Magnetic resonance contraindicated or unavailable.

Radiologic Exam Procedure	Appropriateness Rating	Comments
Brain		
Computed tomography	8	
Computed tomography + contrast	8	
Spinal cord		
Computed tomography	4	
Computed tomography myelography	4	May be valuable for difficult differential diagnosis (e.g., excluding mass lesions). In some patients even non-ionic contrast media may worsen the syndrome.
Computed tomography + contrast	3	
Conventional myelography	2	In some patients, even non-ionic contrast media may worsen the syndrome.
Appropriateness Criteria Scale 1 2 3 4 5 6 7 8 9 1=Least appropriate 9=Most appropriate		

Summary

Imaging and Clinical Presentation

When considering the appropriateness of imaging procedures for the diagnosis of multiple sclerosis, it is important to factor in: (1) the likelihood that a given clinical presentation represents demyelinating disease or other disorder that can be imaged, and (2) the likelihood that the use of an imaging modality will change the management of the disorder. Up to 40% of patients with proven multiple sclerosis first present with paresthesias or other vague sensory symptoms. Pain can also be the first symptom. The proportion of patients with similar sensory symptoms who have multiple sclerosis has not been studied systematically. Some patients present with sensory patterns strongly suggestive of spinal cord involvement, with a clear-cut sensory level and a band of paresthesia at the appropriate location. Many others, however, present with symptoms that cannot be precisely localized to peripheral nerve, cord, or sensory pathways in the brain stem or above. These patients often have pain or paresthesias that are evoked from myofascial or other structures and do not represent neurological sensory impairment. Costly imaging procedures are not as justified in this group of patients as when the presentation includes motor findings that more conclusively betray neurological involvement. In practice, physicians more often err by neglecting to study adequately patients with seemingly minor sensory complaints that represent the first manifestation of a potentially treatable neurological disorder. However, once a less-expensive, well-chosen imaging modality fails to show central nervous system pathology, the need to proceed with more expensive procedures should be carefully weighed. As an example, patients with sensory symptoms and negative magnetic resonance imaging of the brain and spinal cord, if they have multiple sclerosis, are likely to have the benign variety, for which at the moment there is no adequate treatment. Pursuing imaging beyond the screening procedures may not be indicated.

X-ray Computed Tomography

The sensitivity of computed tomography of the brain for multiple sclerosis is low. Indirect findings, such as areas of hypodensity or brain atrophy, appear late in the disease and are nonspecific. In a study of 85 patients with multiple sclerosis, abnormal enhancing areas were demonstrated in 29%. There was a strong correlation between clinical exacerbation and abnormal contrast enhancement. Even with the use of double-dose contrast enhanced computed tomography, the area under the receiver-operating characteristic curve for multiple sclerosis was 0.52 in a study of 303 patients. Computed tomography is useful to detect brain or spinal cord lesions other than multiple sclerosis in patients with neurological symptoms who cannot have magnetic resonance imaging. In these cases, the test should be performed with and without contrast enhancement. If there is enhancement in multiple sclerosis the ring of enhancement may be open in areas of the lesion abutting gray matter, an unusual finding in neoplasms and infection.

Magnetic Resonance Imaging

Larger studies on the sensitivity and specificity of magnetic resonance imaging for multiple sclerosis have used conventional magnetic resonance imaging sequences. In a study of 303 patients referred because of the suspicion of multiple sclerosis, a "definite multiple sclerosis" reading on an magnetic resonance imaging of the head was specific for multiple sclerosis (likelihood ratio, 24.9) and essentially established the diagnosis, especially in patients clinically designated as probable multiple sclerosis before testing. However, magnetic resonance imaging of the head was negative for multiple sclerosis in 25% and equivocal in 40% of the patients considered to have multiple sclerosis by the diagnostic review committee reviewing each patient's course after a 6-month follow-up. Studies of clinically definite multiple sclerosis yielded a sensitivity for magnetic resonance imaging of 70-83%. Many of the patients with negative brain studies may have had spinal cord lesions, undetected by these studies because the spinal cord was not systematically surveyed. In a group of 170 multiple sclerosis patients with symptoms and signs referable to the spinal cord or optic nerves, 20 (12%) had normal brain magnetic resonance imaging. On the other hand, patients presenting with a myelopathic picture often have brain lesions on magnetic resonance imaging. Even in early magnetic resonance imaging studies, this technique was found to be more sensitive than cerebral spinal fluid monoclonal banding for the diagnosis of multiple sclerosis. Magnetic resonance imaging was also more sensitive than neurophysiological evoked response studies.

As Drayer predicted in the early 1990's, brain magnetic resonance imaging has been used in recent, large therapeutic trials to monitor multiple sclerosis disease activity. In relapsing-remitting and secondary progressive multiple sclerosis, serial T2-weighted magnetic resonance imaging reveals 3-10 times as many new lesions as there are clinical relapses. Gadolinium-diethylene-triaminepenta-acetic acid enhancement, by detecting blood-brain barrier breakdown and inflammation in new and reactivated chronic lesions, further increases the reliability and sensitivity of detecting active lesions. In relapsing-remitting and secondary progressive multiple sclerosis, the presence of such enhancement is more frequent during relapse and correlates well with clinical activity. Enhancement is rare in primary progressive multiple sclerosis. In benign multiple sclerosis, with a slow progression and little disability, enhancing lesions are also rare. On magnetic resonance imaging, patients with primary progressive disease tend to have cord atrophy, absent in the group with benign multiple sclerosis.

Because of its greater sensitivity for the detection of edematous lesions in the neighborhood of cerebral spinal fluid-filled spaces, fluid-attenuated inversion recovery with fast spin-echo acquisition is quickly becoming a standard sequence in clinical magnetic resonance imaging. In earlier studies, fluid-attenuated inversion recovery images were found to be more sensitive for cord multiple sclerosis lesions than conventional T2-weighted images. In order to reduce scanning time, fast fluid-attenuated inversion recovery sequences are now in widespread use. More sensitive than conventional spin-echo for supratentorial multiple sclerosis lesions, fast fluid-attenuated inversion recovery lacks adequate sensitivity in the brain stem and spinal cord.

The sensitivity of magnetic resonance imaging for the detection of active brain lesions can be increased by injecting larger doses of contrast material, up to 0.3 mmol/kg (triple dose). Use of magnetization transfer contrast may increase the yield even further. Delayed scanning, up to 40-60 minutes after injection, also improves sensitivity. Combining delayed scanning, triple-dose Gd-DTPA and magnetization transfer contrast, Silver and coworkers more than doubled the number of enhancing lesions detected in relapsing-remitting multiple sclerosis. The detection of enhancing lesions can also be improved by obtaining very thin sections. A high-resolution three-dimensional T1-weighted gradient echo sequence yields 1-mm-thick sections. Time-consuming and more expensive than conventional magnetic resonance imaging, these methods should be reserved for cases in which conventional studies fail to answer relevant clinical or research questions. For instance, a patient with clinically suspected multiple sclerosis on the basis of motor findings, who has a negative brain and spinal cord survey, may benefit from more sensitive studies. On the other hand, if they have multiple sclerosis, such patients are likely to have either benign multiple sclerosis or primary progressive multiple sclerosis. Given their side effects and cost, current therapies are not indicated for benign multiple sclerosis. Their benefit for primary progressive multiple sclerosis is not proven and is being evaluated in prospective therapeutic trials. Thus, additional imaging may not be needed in such cases.

In large multiple sclerosis therapeutic trials, serial brain studies were useful to show treatment group differences, but a poor correlation was noted between new lesion development and the nature of clinical relapses. This discrepancy can be explained by the different clinical impact of lesions in different areas of the neuraxis. For instance, cord lesions have a greater tendency to become symptomatic. The cord was not systematically surveyed in the treatment trials. Thorpe and coworkers carried out monthly gadolinium-enhanced brain and spinal cord magnetic resonance imaging scans over one year in ten patients with relapsing-remitting multiple sclerosis. Six of the patients had a total of 11 clinical relapses, eight of which involved the spinal cord. Only one active brain lesion was symptomatic compared with six spinal cord lesions. However, because there was a strong association between the spinal cord and brain magnetic resonance imaging activity, one study concluded that imaging of the brain alone will detect 90% of active lesions, and spinal cord magnetic resonance imaging using current technology will therefore provide only modest gains in treatment trials in which lesion activity is the primary outcome measure. In terms of the ideal interval for magnetic resonance imaging scanning in therapeutic trials, a monthly scan may suffice. Weekly scans did not increase new lesion yield appreciably in a small sample.

In addition to topography and time-window, other factors may influence the correlation of magnetic resonance images with the clinical picture. Permanent demyelination or axonal loss is likely to result in a permanent deficit, whereas acute demyelination with edema may resolve and therefore have a better prognosis. Putative magnetic resonance imaging markers for permanent lesions include decreased N-acetyl aspartate on proton magnetic resonance spectroscopy, decreased magnetization transfer ratios, hypointensity on T1-weighted images, and loss of short T2 water fractions, some of which may relate more closely to disability than conventional magnetic resonance imaging findings. Some of these variables are likely to be included in future multiple sclerosis therapeutic trials.

Magnetic Resonance Spectroscopy

Magnetic resonance spectroscopy may also help clarify the pathophysiology underlying the diverse varieties of multiple sclerosis. Metabolic changes have been observed on magnetic resonance spectroscopy before the appearance of lesions on magnetic resonance imaging. Regional changes in metabolite levels can be dynamic and reversible in some patients. Transient changes in N-acetyl aspartate levels have been found in acute plaques and indicate that a reduced N-acetyl aspartate level does not necessarily imply axonal loss. Such variations were also detected in chronic unenhancing lesions in patients with secondary-progressive multiple sclerosis, but not in chronic unenhancing lesions in patients with benign multiple sclerosis. Hirsch and coworkers detected a correlation between a composite set of resonances between 2.1 and 2.6 ppm (marker peaks) and the presence of contrast enhancement. Marker peaks may represent myelin breakdown products. Furthermore, the ratio between these marker peaks and the creatinine peak correlated with the degree of enhancement of the lesion. Narayana and coworkers found an inverse correlation between the average N-acetyl aspartate within the spectroscopic volume and the total lesion volume in the whole brain. This negative correlation implies that N-acetyl aspartate can serve as an objective marker of disease burden. In a few instances, researchers observed strong lipid peaks in the absence of gadolinium enhancement and magnetic resonance imaging-defined lesions. This observation suggests that demyelination can occur independent of perivenous inflammatory changes and supports the presence of more than one pathophysiological process leading to demyelination in multiple sclerosis.

Magnetic Resonance Imaging for the Prognosis of Multiple Sclerosis

When a patient has the first demyelinating attack, it becomes important to predict whether the episode will be single or whether the disease will recur, thereby qualifying for the diagnosis of multiple sclerosis. In patients with clinical syndromes of the brain stem, spinal cord or optic nerve, some authors have reported a greater positive predictive value for cerebral spinal fluid oligoclonal bands than for magnetic resonance imaging. However, studies with a longer follow-up or using more advanced magnetic resonance technology found the presence of multiple lesions on magnetic resonance imaging to be the strongest predictor of progression to multiple sclerosis in patients presenting with an acute clinically isolated syndrome of the optic nerves, brainstem, or spinal cord of a type suggestive of multiple sclerosis. Barkhof and coworkers studied 74 patients presenting initially with neurological symptoms suggestive of multiple sclerosis. Of them, 33 (45%) went on to develop clinically definite multiple sclerosis, using Poser's criterion of a second episode in a different location at least 1 month after the original event. The median follow-up period for the portion of the cohort that did not have an additional episode was 39 months. A four-parameter dichotomized magnetic resonance imaging model, including gadolinium-enhancement, juxtacortical, infratentorial, and periventricular lesions, best predicted conversion to clinically definite multiple sclerosis using conventional magnetic resonance imaging sequences.

Magnetic Resonance Imaging in Optic Neuritis

During acute optic neuritis, gadolinium enhancement of some segment of the involved optic nerve is regularly present. A few weeks after the acute event, the proportion of enhancing nerves decreases. Chronic lesions of the optic nerve are poorly seen in conventional spin-echo sequences. Newer sequences, such as frequency-selective fat saturation and inversion recovery with a short inversion time, and long echo time short tau inversion recovery sequences have increased magnetic resonance imaging sensitivity to optic-nerve lesions. More recently, Jackson and coworkers have reported better rendition of optic-nerve atrophy and other lesions after optic neuritis by obtaining both fat and water suppression. They used a selective partial inversion-recovery prepared T2-weighted fast spin echo acquisition, and selective partial inversion-recovery -fluid-attenuated inversion recovery with fast spin echo acquisition . Other techniques reported to differentiate chronic optic-nerve lesions on magnetic resonance imaging include magnetization transfer magnetic resonance imaging and diffusion-weighted magnetic resonance imaging.

The magnetic resonance imaging characteristics of optic-nerve lesions caused by vasculitis resemble those of demyelinating neuropathy. The presence of systemic findings and the more sudden clinical onset help differentiate these disorders. On the other hand, the visual loss of Leber's hereditary optic neuropathy is seldom accompanied by early involvement of the optic nerve on magnetic resonance imaging, rendering this technique useful to differentiate it from demyelinating optic neuritis.

Isolated optic neuritis is often the harbinger of full-blown multiple sclerosis. In the Optic Neuritis Study, 30% of the patients developed clinically definite multiple sclerosis after a 5-year follow-up. Brain magnetic resonance imaging performed at study entry was a strong predictor of developing multiple sclerosis, with the 5-year risk ranging from 16% in the 202 patients with no magnetic resonance imaging lesions to 51% in the 89 patients with three or more magnetic resonance imaging lesions. Similar results have been found in other studies.

Magnetic Resonance Imaging in Cord Lesions and Transverse Myelopathy

Although fluid-attenuated inversion recovery imaging has been reported to enhance lesion visibility in multiple sclerosis, recent studies find this sequence unreliable for lesion detection in the spinal cord. In a recent study, cardiac-triggered dual-echo spin-echo performed slightly better than magnetization transfer-prepared gradient-echo in the definition of spinal cord multiple sclerosis lesions. The longer scanning time may be a problem in some cases.

The magnetic resonance appearance of the spinal cord in patients with multiple sclerosis differs according to clinical subtype. Magnetic resonance lesions are more frequent in patients with secondary-progressive multiple sclerosis and primary-progressive disease than in those with relapsing-remitting disease. Diffuse abnormality without focal lesions characterizes primary-progressive multiple sclerosis. Patients with diffuse abnormalities have a smaller cross-sectional area of the spinal cord and suffer from more disability than patients without diffuse abnormalities.

Some magnetic resonance imaging findings may help distinguish multiple sclerosis plaques in the cord from idiopathic acute transverse myelitis. Acute transverse myelitis presents with a centrally-located hyperintensity occupying more than two thirds of the cross-sectional area of the cord; a length of three to four vertebral segments; a small central area of intensity, isointense with normal cord, in the core of hyperintensity; focal, peripheral cord enhancement, particularly in patients with cord expansion; and a slow regression of T2 hyperintensity with an enhancing nodule. Acute transverse myelitis may be accompanied by gadolinium enhancement of the cauda equina.

Positron Emission Tomography

Positron emission tomography has been used in multiple sclerosis to clarify the nature of brain dysfunction underlying symptoms such as fatigue and memory loss. Fatigue has been correlated with decreased metabolism in the prefrontal areas of the frontal lobe, caudate nuclei and anterior putamen bilaterally. Memory loss has been correlated with decreased metabolism in the left thalamus and in both hippocampi. Of scientific interest, the information currently provided by Positron emission tomography does little to change the clinical management of multiple sclerosis patients.

Single-Photon Emission Computed Tomography

201thallium chloride single-photon emission computed tomography has been used to rule out multiple metastatic lesions in patients with cancer and multiple brain lesions on magnetic resonance imaging. In a patient with Stage III adenocarcinoma of the colon treated with 5-fluorouracil and levamisole, multiple demyelinating lesions developed in the brain. A negative single-photon emission computed tomography thallium scan supported the demyelinating nature of the lesions. Most often, the morphology of the lesions and their topography on magnetic resonance imaging will suffice to make this distinction.

CLINICAL ALGORITHM(S)

Algorithms were not developed from criteria guidelines.

EVIDENCE SUPPORTING THE RECOMMENDATIONS

TYPE OF EVIDENCE SUPPORTING THE RECOMMENDATIONS

The recommendations are based on analysis of the current literature and expert panel consensus.

BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS

POTENTIAL BENEFITS

Appropriate selection of radiologic exams for the diagnosis of patients with multiple sclerosis.

POTENTIAL HARMS

Not stated

QUALIFYING STATEMENTS

QUALIFYING STATEMENTS

An American College of Radiology (ACR) Committee on Appropriateness Criteria and its expert panels have developed criteria for determining appropriate imaging examinations for diagnosis and treatment of specified medical condition(s). These criteria are intended to guide radiologists, radiation oncologists and referring physicians in making decisions regarding radiologic imaging and treatment. Generally, the complexity and severity of a patient's clinical condition should dictate the selection of appropriate imaging procedures or treatments. Only those exams generally used for evaluation of the patient's condition are ranked. Other imaging studies necessary to evaluate other co-existent diseases or other medical consequences of this condition are not considered in this document. The availability of equipment or personnel may influence the selection of appropriate imaging procedures or treatments. Imaging techniques classified as investigational by the U.S. Food and Drug Administration (FDA) have not been considered in developing these criteria; however, study of new equipment and applications should be encouraged. The ultimate decision regarding the appropriateness of any specific radiologic examination or treatment must be made by the referring physician and radiologist in light of all the circumstances presented in an individual examination.

IMPLEMENTATION OF THE GUIDELINE

DESCRIPTION OF IMPLEMENTATION STRATEGY

An implementation strategy was not provided.

INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT CATEGORIES

IOM CARE NEED

Living with Illness

IOM DOMAIN

Effectiveness

IDENTIFYING INFORMATION AND AVAILABILITY

BIBLIOGRAPHIC SOURCE(S)

Masdeu JC, Drayer BP, Anderson RE, Braffman B, Davis PC, Deck MD, Hasso AN, Johnson BA, Masaryk T, Pomeranz SJ, Seidenwurm D, Tanenbaum L. Multiple sclerosis--when and how to image. American College of Radiology. ACR Appropriateness Criteria. Radiology 2000 Jun;215(Suppl):547-62. [88 references]

ADAPTATION

Not applicable: The guideline was not adapted from another source.

DATE RELEASED

1999

GUIDELINE DEVELOPER(S)

American College of Radiology - Medical Specialty Society

SOURCE(S) OF FUNDING

The American College of Radiology (ACR) provided the funding and the resources for these ACR Appropriateness Criteria™.

GUIDELINE COMMITTEE

ACR Appropriateness Criteria™ Committee, Expert Panel on Neurologic Imaging

COMPOSITION OF GROUP THAT AUTHORED THE GUIDELINE

Names of Panel Members: Thomas Masaryk, MD; Burton P. Drayer, MD; Robert E. Anderson, MD; Bruce Braffman, MD; Patricia C. Davis, MD; Michael D. F. Deck, MD; Anton N. Hasso, MD; Blake A. Johnson, MD; Stephen J. Pomeranz, MD; David Seidenwurm, MD; Lawrence Tanenbaum, MD; Joseph C. Masdeu, MD, PhD.

FINANCIAL DISCLOSURES/CONFLICTS OF INTEREST

Not stated

GUIDELINE STATUS

This is the current release of the guideline.

The ACR Appropriateness Criteria™ are reviewed after five years, if not sooner, depending upon introduction of new and highly significant scientific evidence. The next review date for this topic is 2004.

GUIDELINE AVAILABILITY

Electronic copies: Available from the American College of Radiology (ACR) Web site.

Print copies: Available from ACR, 1891 Preston White Drive, Reston, VA 20191. Telephone: (703) 648-8900.

AVAILABILITY OF COMPANION DOCUMENTS

None available

PATIENT RESOURCES

None available

NGC STATUS

This summary was completed by ECRI on July 31, 2001. The information was verified by the guideline developer as of August 24, 2001.

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